

Development of a Water Stick to Measure Nipple Waterer Flow Rates

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Primary Audience: Growers, Flock Supervisors, Extension Specialists, Poultry Researchers

SUMMARY

Inadequate drinking water supplies have been cited as a major reason for poor weight gain in broiler production. One of the limiting factors is nipple waterer flow rate. Research demonstrated a constant water flow rate of 25 mL/min impeded BW by approximately 156 g (0.34 lb) at 6 wk of age compared with those having 75 mL/min through the grow out. A device to measure nipple flow rates was developed from polyvinyl chloride (PVC) pipe, pipefittings, aluminum screen, and a centrifuge tube. The instrument is 41 in. tall so that the user stands to obtain a measurement, eliminating the need to kneel in litter while activating the nipple. This water stick features a screened trip plate to activate the nipple, a clear polypropylene measuring tube, and a pour spout for discarding the sample. Following the description herein, the stick can be easily constructed so that the conscientious integrator, grower, or researcher can assure flocks an adequate drinking water supply.

Key words: broiler, nipple waterer, water, flow rate, performance

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DESCRIPTION OF PROBLEM

Numerous broiler houses across the country employ nipple-watering systems. The advantages of nipple drinkers are reduced spillage and improved sanitation compared with open-type waterers; these benefits have contributed to nipple waterers becoming the standard watering system in broiler production [1]. Early acceptance of the nipple system, however, was slow due to water restriction problems and associated lack of weight gain. Advances in design to overcome restriction and to promote improvements in livability, feed

conversion, and condition of the litter, as well as reduced condemnations, led to acceptance of the nipple system. Lacking the historical perspective of the change to nipples, the new generation of broiler managers and researchers thought an adequate number of the large flow nipples and flow-adjusting regulators in the nipple system would allow management of the system so that drinking water supply problems would not exist. It has been taken for granted that these systems deliver an adequate supply of water to the broiler. However, recent surveys by extension poultry special-

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ists have revealed conflicting results [2]. Problems, such as low nipple pressure, dirty lines or nipples, lines out of level, and an inadequate supply pressure may cause some broiler houses to have insufficient water supplies to maximize the birds' performance at certain times during the grow out [3].

Previously, the nipple flow rate was determined by holding a small graduated cylinder under a nipple and activating the pin on the waterer (by holding the pin up or to 1 side) allowing water to flow. This was performed for 1 min, as timed by the second hand on a wristwatch. During the flow rate measurement, the farmer or serviceman had to kneel in the litter, resulting in a cumbersome, time-consuming, and possibly not very accurate procedure. The idea to design a device to eliminate these problems originated at the Poultry Research Unit, Mississippi State, Mississippi, where researchers fabricated a water-measuring device to efficiently measure, from a standing position, the flow rate of any nipple in an operating nipple drinker system. A description of the water stick is presented herein.

MATERIALS AND METHODS

Prototype

The prototype-measuring device is constructed of one-half-in. PVC pipe with an overall length of 41 in. The major portion of the device provides a handle to permit the grower or service person to stand during operation; about 7 in. of the length is devoted to the measurement assembly. The handle of the water stick is capped on the upper end and plugged on the lower end. A ½-in. "T" is glued to the lower end of the handle, and the horizontal arm remains open for quickly draining the collection tube after a measurement with a flex of the operator's wrist. A second ½-in. "T" is glued to the lower end of the first one. A 50-mL clear polypropylene centrifuge tube attaches to the bottom of the lower "T"; the horizontal arm of this "T" is situated 180° from the horizontal opening of the upper "T." The lower "T" connects to a short length of ½-in. pipe with a ½-in. elbow turned up. The elbow supports a ½- to 1¼-in. fitting; inside the fitting is a hand drilled aluminum screen for activating the nipple water flow.

Commercial Version

A major poultry product supply company [4] has commercially fabricated the water-measuring device (Figure 1). For ease of transport and conservation of storage space, the manufacturer improved the design by constructing the water stick so that it disassembles into 2 pieces. The commercial stick is made from the square PVC tubing (⅝-in. diameter) from which the nipple waterer lines are fabricated. The overall length of the commercial version is 42 ½ in. with the first section break 15 in. from the top of the handle. The sections are joined with a friction-fitted run-on connector with "O" rings. At 31 in. from the upper end square to round fittings transition the pipe to ¾-in. fittings. Two three-fourths-in. "T"s, with horizontal arms 180° apart, are solvent welded to the lower end of the handle. The upper "T" opening provides the drain for emptying the measuring tube. At the lower end, a 50-mL clear, graduated polypropylene centrifuge tube threads onto the lower "T." The catch cup fitting is situated horizontally off the lower "T" with a piece of aluminum screen inside this fitting. The aluminum screen on the cup acts as a trip plate to activate the nipple flow (Figure 2).

Water Flow Rate Measurement

The water stick is used in a similar manner as the older method in that the nipple is triggered; a volume of water collected, and the water collection is timed. The grower or serviceman holds the upper end of the water stick and engages a nipple with the screened trip plate. Water flows through the screen and into the centrifuge tube. The water collection is timed for 15 or 30 s, using the second hand on a wristwatch or a stopwatch. The resulting water collected (mL) is divided by the number of minutes (0.25 or 0.5, respectively) to obtain the milliliter per minute flow rate. The water is discarded by pouring it out through the horizontal arm of the upper "T" of the device.

In an effort to test the hypothesis that low nipple flow rate hinders broiler performance, the water stick was used to optimize water flow rates at 25, 50, and 75 mL/min. Seventy 1-d-old, male chicks were reared in environmental chambers to 6 wk of age. Feed, crumbles 0 to 3 wk, pellets 3 to 6 wk, and water, according to treatment restrictions, were provided ad libitum. Lighting was

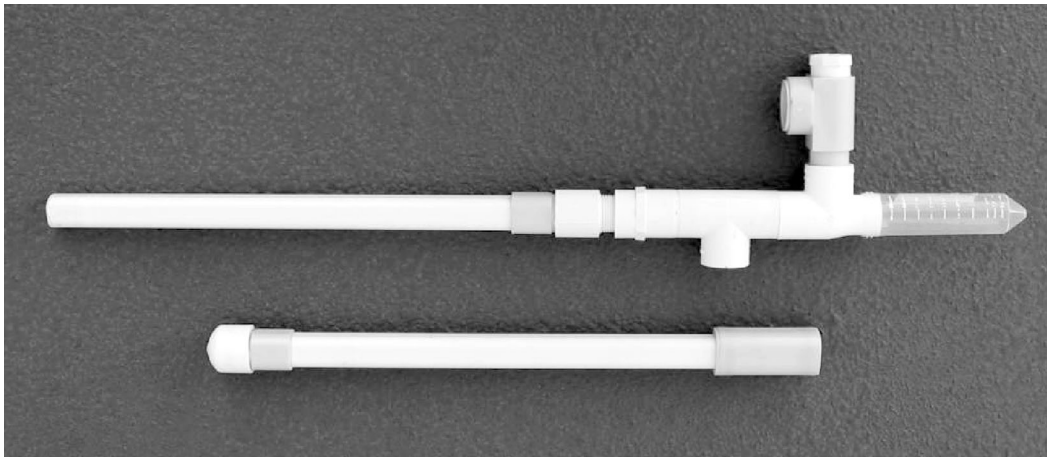


FIGURE 1. The water-measuring device with top section of the handle detached.

continuous; temperature began at 89.6°F (32°C) and was reduced 5°F (2.6°C) weekly to reach 80°F (26.7°C). An ANOVA was performed for a split-plot design in which the main unit treatments are 3 nipple water flow levels, and the main unit has a completely random design with 2 chambers for each water flow. The subunit is a repeated measure for weeks. Treatment means were declared significant based on least significant difference at $P < 0.05$, using the mixed procedure model of SAS software [5].



FIGURE 2. On right, aluminum screen trip plate on commercial water stick (used to trigger nipple waterer).

RESULTS AND DISCUSSION

Although water is the most important nutrient to poultry, factors related to its supply, like flow rate, waterer height, and water quality, can very often be taken for granted as evidenced by the scarcity of topical literature. A decade ago, Carpenter et al. [6] reported significant effects of high (2.3 mL/s or 138 mL/min) vs. low (0.4 mL/s or 24 mL/min) volume nipple water flow when male broilers were raised in a summer-like environment. In that study, male broilers exhibited higher BW and livabilities when provided the higher water flow rate. In 2002, Dozier et al. [7] found that the ratio of water to feed consumption is 1.6:1 over the entire flock, but that ratio increases with increasing environmental temperature. Recent work at this laboratory [8] determined that decreasing flow rate from 75 to 25 mL/min reduced final BW by 0.34 lb (154 g) and breast meat yield by 14%. Additionally, an equation was developed for recommending water flow rate based on broiler age, which is 7 mL/min per week of age plus 20 mL/min [8].

In the current study, where nipple water flow rate was regulated at 25, 50, and 75 mL/min using the water stick, the greater flow rates exhibited a significant improvement in BW at 4 wk of age that continued through wk 5 and 6. Table 1 provides the data for BW, feed:gain, and average weekly weight gain. Feed conversion, though improved with increase in water flow rate, did not

TABLE 1. Male broiler response to nipple water flow rate

Water flow rate (mL/min)	Age (wk)					
	1	2	3	4	5	6
25	144	390	803	1,344 ^b	1,916 ^b	2,465 ^b
50	143	405	836	1,398 ^{ab}	2,017 ^a	2,566 ^a
75	143	401	839	1,419 ^a	2,043 ^a	2,621 ^a
LSD = 38.7 ^A						
	Feed:gain					
	1	2	3	4	5	6
25		1.33	1.40	1.65	2.04	2.36
50		1.28	1.36	1.55	1.81	2.08
75		1.31	1.35	1.53	1.78	2.03
LSD = 0.26						
	Average gain (g)					
	1	2	3	4	5	6
25		244	403	515	519 ^b	492
50		261	431	562	620 ^a	549
75		259	437	580	625 ^a	578
LSD = 65.0						

^{a,b}For a given week (column), means with different letters differ significantly ($P \leq 0.05$).

^ALSD = least significant difference.

meet significance criteria. Average weekly weight gain was significant in wk 5.

Earlier work [1, 9, 10] demonstrated that nipple height influences broiler performance. May et al. [9] reported 4-lb and larger broilers have difficulty drinking in hot weather due to panting, and lowering the nipple height for these large birds during high temperature periods improved broiler growth and feed conversion [10]. Similarly, upon placement of chicks, nipple height is important. Branton et al. [1] reported a field observation of a high incidence of mortality at 2 d of age with the primary cause being nipple waterers inadvertently set too high. However, Feddes et al. [11] demonstrated nipple den-

sity does not alter broiler performance or carcass quality.

Water flow rate and line height can be optimized. Integrators and growers can work together to improve the management of individual nipple watering systems to overcome factors, such as low nipple pressure, water lines out of level, or dirty nipples or lines. Measuring the nipple flow rate across the house may bring to light the areas requiring attention. The development of the previously described nipple waterer flow measurement device contributes a fast and accurate method for eliminating too low water flow as a factor detrimental to broiler performance.

CONCLUSIONS AND APPLICATIONS

1. Nipple water flow rates should be measured to ensure optimal broiler performance.
2. A water stick or device for measuring nipple flow rate from a standing position was developed, allowing growers and service personnel to easily ensure adequate drinking water flow rate.
3. The water stick is commercially available or can be constructed from readily available components.

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